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Interface scattering and thermal conductivity in Si/SiGe alloy superlattices[1] ZLATAN AKSAMIJA, University of Wisconsin-Madison, IRENA KNEZEVIC, Univeristy of Wisconsin-Madison — $Si/Si_{1-x}Ge_x$ alloy superlattices (SLs) show promise for application as efficient thermoelectrics because of their low thermal conductivity, below that of the bulk $Si_{1-x}Ge_x$ alloy. Lattice thermal conductivity in these superlattices is dominated by scattering from the rough interfaces between layers, even at room temperature. Therefore, interface properties, such as roughness, orientation, and composition, are expected to play a significant role in thermal transport and offer additional degrees of freedom to control the thermal conductivity in semiconductor nanostructures based on superlattices. In this paper, we demonstrate the sensitivity of the lattice thermal conductivity in SLs to the interface properties, using a momentum-dependent model for scattering of phonons from rough material interfaces. Our results show excellent agreement with experimental data and explain the measured thickness and temperature dependence, as well as anisotropy of thermal conductivity in superlattices.

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